

# Integrating Ethics in Computer Science with Inquiry-Based Learning

## OER Reusable Abstract Model with Instance about Relational Database Design

This **Open Educational Resource (OER)** integrates the **ACM Code of Ethics and Professional Conduct** into the computer science curriculum using an **Inquiry-Based Learning (IBL)** approach. It provides both a generic, **reusable IBL model** and a specific **instantiation about Relational Database Design**.

The resource has three primary goals:

1. **Embed ethics directly** into software development practices.
2. **Develop critical thinking skills** by encouraging students to discuss, reflect, and articulate their own ethical positions. Specifically, students are expected to **generate questions, articulate their positions, self-evaluate, and avoid simple information regurgitation**.
3. Provide opportunities for students to **develop and practice essential soft skills**.

Explicitly designed for **Reuse, Revision, and Remixing**—core tenets of OER—the document is structured for maximum adaptability. It first presents a **generic, abstract IBL model**. This model incorporates **guided and open inquiry** and integrates the use of **generative AI (gen-AI) tools**. This generic model is then **instantiated with a sample case** to illustrate practical application and adaptation for creating additional lesson plans. Finally, the OER includes suggestions for **student data collection** with related instruments, as well as **commented solutions** illustrating the difference between average and excellent students' work.

Part of this material has already been formally **evaluated** (Rajan and Cortinovis, 2024). A larger evaluation trial is planned for **2026**, involving institutions in **Singapore, the US, and Italy**. An AI-based application is being developed to automatically generate additional instances.

### 1. Generic abstract model

The **lesson plan** is **grounded in Inquiry-Based Learning (IBL)**, encouraging students to **generate questions, construct explanations, and engage in self-reflection**. Following the **5E instructional model** (i.e., **Engage, Explore, Explain, Elaborate, and Evaluate**), this approach ensures a progressive and comprehensive learning path.

The **ACM Code of Ethics and Professional Conduct** is treated not as abstract theory, but as a **living framework for professional decisions**.

The activity intentionally contrasts phases where **gen-AI use is restricted** (to foster independent **critical** reasoning) and phases where **gen-AI is permitted** (to highlight both its **potential** and its **limitations** in complex ethical reasoning). This dual stance helps students critically evaluate AI outputs rather than relying on them without scrutiny.

The activities for the first phase (Engage) and the final phase (Evaluate) are largely specified. The intermediate phases (Explore, Explain, and Elaborate) are outlined only in general terms and **will be detailed** according to the **specific computing subject** in which ethics will be integrated.

| Phase                              | General purpose                                                                                                                                                                                                              | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Engage</b>                      | Spark interest and curiosity. Situate learning in a meaningful context. Encourage questions and inquiry.                                                                                                                     | <ul style="list-style-type: none"> <li>• <b>Preliminary familiarization.</b> Ask students to critically read the <i>ACM Code of Ethics and Professional Conduct</i>. Lead an introductory group discussion on the importance of ethics in computer science, prompting students to identify key issues and illustrate them with practical examples.</li> <li>• <b>Debate on ethical dilemmas.</b> The aim of this step is to introduce motivating and thought-provoking cases to illustrate that applying the <i>ACM Code of Ethics and Professional Conduct</i> is not always straightforward. A compelling example is decision-making in autonomous vehicles. Present the <a href="#">Moral Machine</a> (Awad et al., 2018) scenarios to the class and, for each case, ask students to discuss the options, identify the most appropriate decision, justify their choice, and connect it to relevant aspects of the Code.</li> </ul> |
| <b>Explore</b>                     | Provide direct experience of a phenomenon or concept. Encourage students to investigate their questions, test ideas, and solve problems.                                                                                     | <ul style="list-style-type: none"> <li>• <b>First artifact development.</b> Ask students to create a first artifact (e.g., a short report, a conceptual diagram, or a prototype) on a specified topic, explicitly highlighting the connections with the <i>ACM Code of Ethics and Professional Conduct</i>.</li> <li>• <b>Documentation.</b> Students should submit the artifact.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Explain</b><br>[guided inquiry] | Introduce conceptual tools to interpret evidence and construct explanations. Support multi-modal explanations and justify claims based on gathered evidence. Compare explanations generated by different students or groups. | <ul style="list-style-type: none"> <li>• <b>Multi-modal extension of the artifact.</b> Ask students to improve the previous artifact or represent it using a different modality and set of tools, in order to address specified ethical implications. They may freely use Internet resources, but gen-AI tools are not allowed.</li> <li>• <b>Documentation.</b> Students should submit this new artifact.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Elaborate</b><br>[open inquiry] | Apply concepts and explanations in new contexts to test general applicability. Reconstruct and extend understanding using multiple modes, such as written language, diagrams, graphics, and mathematics.                     | <ul style="list-style-type: none"> <li>• <b>Further artifact enhancement.</b> Ask students to identify extensions or improvements to their previous artifact, integrating new ethical aspects that they must autonomously identify and justify. Here, they may freely use a gen-AI tool. To maximize ethical insight, students should formulate complex, analytical prompts that require the AI to engage with nuanced ethical reasoning, rather than generic queries.</li> <li>• <b>Documentation.</b> Students should submit the prompts they used with the tool, as well as the improved artifact.</li> </ul>                                                                                                                                                                                                                                                                                                                      |
| <b>Evaluate</b>                    | Offer opportunities for students to review and reflect on their learning, understanding, and skills. Provide evidence of changes in students' knowledge, beliefs, and abilities.                                             | <ul style="list-style-type: none"> <li>• <b>Presentation of results.</b> Ask students to present their results to the class (5–10 minutes) followed by a 10-minute Q&amp;A session.</li> <li>• <b>Peer interaction.</b> Require each student to ask at least one question to another student.</li> <li>• <b>Peer evaluation.</b> Ask students to evaluate one or more presenters on content, structure, and communication, noting first what they liked about the presentation and then what could be improved.</li> <li>• <b>Documentation.</b> Students should submit their presentation, questions, and evaluations.</li> </ul>                                                                                                                                                                                                                                                                                                    |

## 2. Sample instance: Ethics and Relational Database Design

This example application of the abstract model in the context of relational database design for a healthcare clinic requires only minor modifications in the Explore, Explain, and Elaborate phases. In short:

- **Engage:** Students read the ACM Code and discuss ethical dilemmas.
- **Explore:** Each student proposes how ethical guidelines could shape a clinic database, producing a report or concept map.
- **Explain:** Students build an Entity-Relationship Diagram (ERD) incorporating patient consent management and privacy safeguards, linking design choices to the Code.
- **Elaborate:** Using a gen-AI tool, students identify additional ethical concerns (e.g., secondary data use, algorithmic bias in patient categorization) and refine their ERDs accordingly.
- **Evaluate:** Results are presented, discussed, and peer-reviewed.

### 2.1 Lesson plan for the teacher

Duration: 12 hours.

| Phase                         | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Engage</b><br>(3 hours)    | <ul style="list-style-type: none"><li>• <b>Preliminary familiarization.</b> Ask students to critically read the <i>ACM Code of Ethics and Professional Conduct</i>. Lead an introductory group discussion on the importance of ethics in computer science, prompting students to identify key issues and illustrate them with practical examples.</li><li>• <b>Debate on ethical dilemmas.</b> The aim of this step is to introduce motivating and thought-provoking cases to illustrate that applying the <i>ACM Code of Ethics and Professional Conduct</i> is not always straightforward. A compelling example is decision-making in autonomous vehicles. Present the <a href="#">Moral Machine</a> (Awad et al., 2018) scenarios to the class and, for each case, ask students to discuss the options, identify the most appropriate decision, justify their choice, and connect it to relevant aspects of the Code.</li></ul> |
| <b>Explore</b><br>(2 hours)   | <ul style="list-style-type: none"><li>• <b>First artifact development.</b> Ask students to individually reflect on how ethical guidelines from the <i>ACM Code of Ethics</i> could influence the design of a database for a personalized healthcare clinic. Students should produce a brief report or a conceptual map.</li><li>• <b>Documentation.</b> Students should submit the document they produced.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Explain</b><br>(2 hours)   | <ul style="list-style-type: none"><li>• <b>Multi-modal extension of the artifact.</b> Ask students to develop a first version of the clinic database Entity-Relationship Diagram (ERD), incorporating ethical aspects they consider relevant. In particular, the ERD should account for detailed records of patient consents for treatments, data sharing for research purposes, and other privacy-related permissions. Students should provide comments on the schema, explicitly linking ERD features to items in the ACM Code of Ethics. They may freely use Internet resources, but gen-AI tools are not allowed.</li><li>• <b>Documentation.</b> Students should submit the ERD together with comments explaining the ethical considerations included.</li></ul>                                                                                                                                                              |
| <b>Elaborate</b><br>(2 hours) | <ul style="list-style-type: none"><li>• <b>Further artifact enhancement.</b> Ask students to use Gemini to identify additional ethical considerations to integrate into the ERD. Students must formulate complex, analytical prompts that require the AI to engage with nuanced ethical reasoning (e.g., focusing on trade-offs between two specific ACM principles). Ensure that specific ERD features are explicitly connected to relevant items in the ACM Code of Ethics.</li><li>• <b>Documentation.</b> Students should submit the improved ERD, include comments linking the new extensions to the ACM Code, and document the prompts used with the gen-AI tool. The submitted documentation should also include a brief (2-3 sentence) justification for why the chosen prompt was designed to elicit complex ethical insight.</li></ul>                                                                                   |
| <b>Evaluate</b><br>(3 hours)  | <ul style="list-style-type: none"><li>• <b>Presentation of results.</b> Ask students to present their results to the class (5–10 minutes) followed by a 10-minute Q&amp;A session.</li><li>• <b>Peer interaction.</b> Require each student to ask at least one question to another student.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

|  |                                                                                                                                                                                                                                                                                                                                                                        |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <ul style="list-style-type: none"> <li>• <b>Peer evaluation.</b> Ask students to evaluate one or more presenters on content, structure, and communication, noting first what they liked about the presentation and then what could be improved.</li> <li>• <b>Documentation.</b> Students should submit their presentation, question(s), and evaluation(s).</li> </ul> |
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## 2.2 Data Collection

This section suggests possible data to be collected, and the associated instruments. These suggestions can be adapted based on specific research or instructional objectives.

### Pre-Activity Survey (5 minutes)

#### 1. Familiarity

- How familiar are you with the ACM Code of Ethics?  
(1 = Not at all, 5 = Very familiar)

#### 2. Confidence

- How confident are you in applying ethical principles to technical design (e.g., database, software)?  
(1 = Not confident, 5 = Very confident)

#### 3. Expectations

- What do you expect to learn from this activity? (*open text*)

### Post-Activity Survey (5–7 minutes)

#### 1. Learning Outcomes

- I feel more confident applying the ACM Code of Ethics to technical work. (1–5 Likert)
- I can connect ethical principles to design choices in my field. (1–5 Likert)

#### 2. Engagement with IBL 5E

- Please rate how much each phase contributed to your learning (1=Least, 5=Most):  
Engage:  
Explore:  
Explain:  
Elaborate:  
Evaluate:
- Which phase contributed most to your learning? Why? (*open text*)

#### 3. Use of gen-AI (Elaborate Phase)

- Using a gen-AI tool helped me broaden my ethical reflection. (1–5 Likert)
- Please describe one useful or problematic aspect of using AI in this context. (*open text*)

#### 4. Global Perspectives

- Which principle of the ACM Code felt most relevant in your context? (open text, e.g., privacy, fairness, professional responsibility)

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#### Artifact Evaluation Rubric (for Explore, Explain, Elaborate phases)

| Criterion                                                                                | Excellent (5)                                                         | Good (4)                                   | Fair (3)                               | Limited (2)                         | Poor (1)                 |
|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|--------------------------------------------|----------------------------------------|-------------------------------------|--------------------------|
| <b>Clarity</b> (technical accuracy & organization)                                       | Artifact is complete, well-structured, and technically accurate       | Mostly accurate and clear                  | Some inaccuracies or unclear structure | Many errors, weak organization      | Incomplete / incoherent  |
| <b>Ethical Alignment</b> (explicit reference to ACM Code)                                | Strong, explicit references to multiple, distinct ACM Code principles | Some explicit references                   | General mention without clear links    | Very limited or vague references    | No ethical consideration |
| <b>Depth of Reasoning</b> (quality of justification)                                     | Thorough, insightful ethical reasoning with justification             | Mostly well-justified, minor gaps          | Some justification but superficial     | Minimal reasoning, poorly justified | No reasoning             |
| <b>Innovation</b> ( <i>Elaborate only</i> ) (integration of AI and new ethical insights) | AI prompts & outputs clearly integrated, expand ethical scope         | AI used meaningfully, adds some new points | AI use adds little depth               | AI use superficial or irrelevant    | No AI use                |

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#### Peer Evaluation Rubric (Evaluate phase)

Students rate a peer presentation (1–5 scale + comments):

1. **Content:** Was the presentation informative, accurate, and well-connected to the ACM Code?
  2. **Structure:** Was it logically organized and easy to follow?
  3. **Communication:** Was the delivery clear, engaging, and professional?
  4. One thing I liked
  5. One thing to improve
- 

#### Reflection Prompts (Evaluate phase)

To be submitted individually:

1. Which ACM Code principle(s) most influenced your artifact design?
2. Did your understanding of the ACM Code change through this activity? How?
3. What did you learn from your peers' presentations about ethics in computing?

## 2.3 Commented sample solutions

This section provides partial solutions illustrating the difference between average and excellent work.

### 2.3.1 Partial average solution provided by a student

Here is a possible **average solution**. It is characterized by:

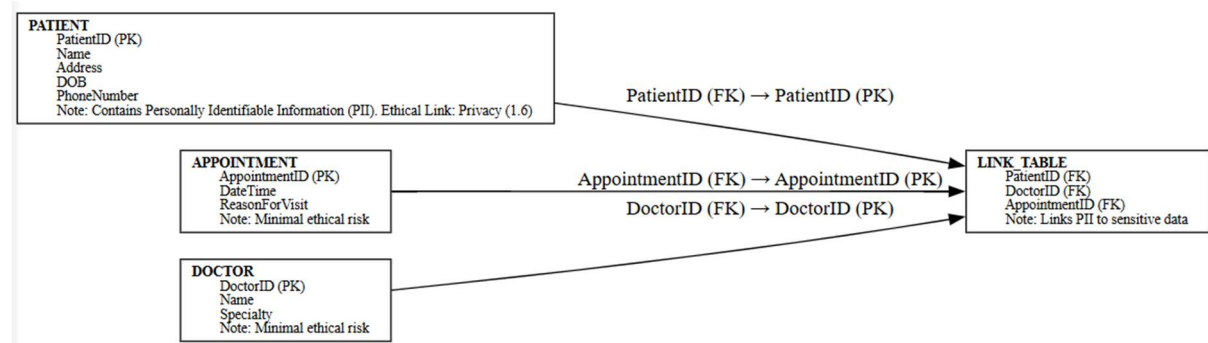
1. Focusing on the most obvious ethical principle: **Privacy (Code 1.6)**.
2. Making a **correct but minimal** change to the technical artifact (the ERD).
3. Using a **generic Gen-AI prompt** that asks for a list of issues rather than resolving a trade-off.

The provided work is **accurate, compliant, and functional**, but it **lacks critical depth, originality**, and the ability to **address complex ethical trade-offs** that define true professional judgment. The student achieves the objective of integration but does so by following the path of least resistance.

### Explain Phase Artifact: Initial ERD and Ethical Justification

The student designs a functional ERD but incorporates only the most direct ethical consideration: ensuring patient confidentiality.

#### Artifact: Simplified ERD



| Entity             | Attributes                                      | Ethical Link (Code 1.6)                                                        |
|--------------------|-------------------------------------------------|--------------------------------------------------------------------------------|
| <b>PATIENT</b>     | PatientID (PK), Name, Address, DOB, PhoneNumber | <b>Clear ethical risk:</b> Contains Personally Identifiable Information (PII). |
| <b>APPOINTMENT</b> | AppointmentID (PK), DateTime, ReasonForVisit    | Minimal ethical risk.                                                          |
| <b>DOCTOR</b>      | DoctorID (PK), Name, Specialty                  | Minimal ethical risk.                                                          |

| Entity            | Attributes                                        | Ethical Link (Code 1.6)      |
|-------------------|---------------------------------------------------|------------------------------|
| <b>Link Table</b> | PatientID (FK), DoctorID (FK), AppointmentID (FK) | Links PII to sensitive data. |

**Student Justification (Low Complexity):** "My main ethical concern is **Privacy (ACM Code 1.6)** because the PATIENT table has sensitive data like names and dates of birth. The main ethical solution I put in is that the ReasonForVisit is only linked to the patient through the APPOINTMENT ID, not directly to the name. This is a basic way to follow Code 1.6."

**Elaborate Phase Artifacts: Gen-AI Prompt and Artifact Refinement**

The student uses a generic Gen-AI prompt and makes a simple, compliant change to the ERD.

**A. Gen-AI Prompt (Generic)**

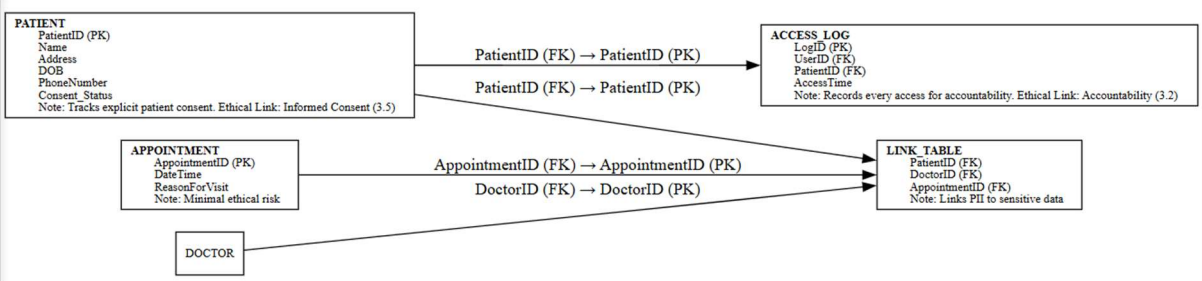
The prompt is functional but asks for a list of issues, not for the resolution of a trade-off.

| Student's Prompt                                                                                                                                                                        | Analysis (Why this is Low Complexity)                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| "I designed a patient scheduling database. What are three ethical problems with it, and how can I fix them based on the ACM Code of Ethics, especially around privacy and data access?" | This is a <b>generic question</b> that asks for a list of issues. It doesn't reference specific entities, attributes, or ask the AI to resolve a conflict between two ACM principles (e.g., Privacy vs. Professional Competence). |

**B. Refined ERD (Minimal Improvement)**

Based on a generic AI output that likely suggested limiting access to sensitive data, the student implements a simple security feature.

**Artifact:** Refined ERD (Change in **bold**)



| Entity         | Attributes                                      | Ethical Link (Code 1.6/3.2) |
|----------------|-------------------------------------------------|-----------------------------|
| <b>PATIENT</b> | PatientID (PK), Name, Address, DOB, PhoneNumber | ...                         |

| Entity               | Attributes                                   | Ethical Link (Code 1.6/3.2)                                                                                          |
|----------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| <b>APPOINTMENT</b>   | AppointmentID (PK), DateTime, ReasonForVisit | ...                                                                                                                  |
| <b>Link Table</b>    | ...                                          | ...                                                                                                                  |
| <b>NEW ENTITY</b>    | <b>ACCESS_LOG</b>                            | <b>This table records every time a user accesses a patient record. (Ethical Link: Accountability, Code 3.2)</b>      |
| <b>NEW ATTRIBUTE</b> | <b>PATIENT.Consent_Status</b>                | <b>A required field to track patient's explicit consent for data use. (Ethical Link: Informed Consent, Code 3.5)</b> |

**Student Justification for Refinement:** "The AI told me that unauthorized access is a big risk, which is part of **Code 3.2 (Know and respect existing laws pertaining to professional work)**. My initial ERD didn't have any way to check who looked at the patient data. My fix was to add a new **ACCESS\_LOG** entity. This doesn't change the patient data, but it keeps a record of who accessed it, which makes the system more accountable and secure. I also added a **Consent\_Status** field as the AI suggested to track if the patient gave permission (**Code 3.5**)."

### 2.3.2 Partial excellent solution provided by a student

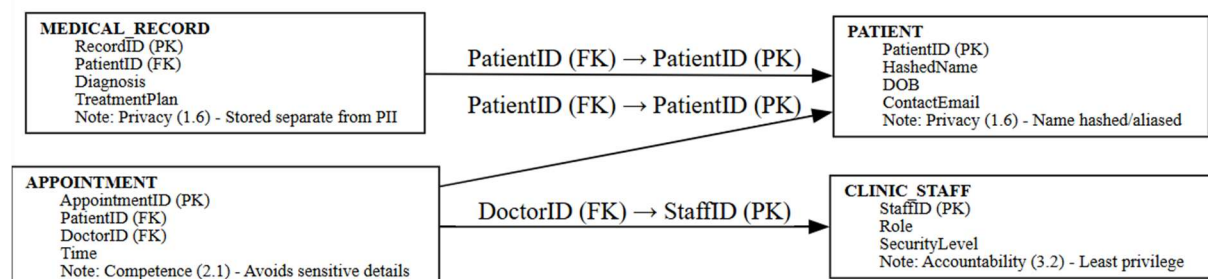
This example illustrates an example of **excellent work**.

The student goes beyond basic compliance (Code 1.6: Privacy) to identify and address a **conflict** (trade-off) between two ACM principles. Their Gen-AI prompt is **analytical**, and their ERD refinement is **nuanced**, demonstrating a deeper understanding of systems design and ethical accountability.

### Explain Phase Artifact: Initial ERD and Ethical Justification

The excellent student immediately identifies a **potential ethical trade-off** between two principles: **Privacy (Code 1.6)** and **Professional Competence/Accountability (Code 2.1/3.2)**. They design the initial ERD to minimize data exposure while ensuring doctors have the necessary information.

#### Artifact: Initial ERD



| Entity                | Attributes                                              | Ethical Link                                                                                                                                   |
|-----------------------|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PATIENT</b>        | PatientID (PK), HashedName, DOB, ContactEmail           | <b>Privacy (1.6):</b> The name is immediately hashed/aliased, minimizing PII exposure to non-essential staff.                                  |
| <b>MEDICAL_RECORD</b> | RecordID (PK), PatientID (FK), Diagnosis, TreatmentPlan | <b>Privacy (1.6):</b> This data is kept separate from PII and linked only by a foreign key.                                                    |
| <b>APPOINTMENT</b>    | AppointmentID (PK), PatientID (FK), DoctorID (FK), Time | <b>Professional Competence (2.1):</b> Includes PatientID for scheduling/doctor preparation, but avoids storing sensitive medical details here. |
| <b>CLINIC_STAFF</b>   | StaffID (PK), Role, SecurityLevel                       | <b>Accountability (3.2):</b> Explicitly includes SecurityLevel to enforce least privilege access.                                              |

**Student Justification (High Complexity):** "My design focuses on a trade-off between **Code 1.6 (Privacy)** and **Code 2.1 (Professional Competence)**. We must protect PII, so I hash the patient's name immediately. However, doctors need to prepare for appointments, so the APPOINTMENT entity must retain a link to the patient ID. The ethical choice here is to **minimize PII** (by hashing the name) while still **enabling necessary professional work** (by keeping the ID link), and relying on the CLINIC\_STAFF entity's SecurityLevel attribute to enforce that only authorized users can link the hash back to the real name."

### Elaborate Phase Artifacts: Gen-AI Prompt and Artifact Refinement

Here the Gen-AI tool is used to directly address the trade-off they identified, seeking a **technical solution** to reinforce accountability.

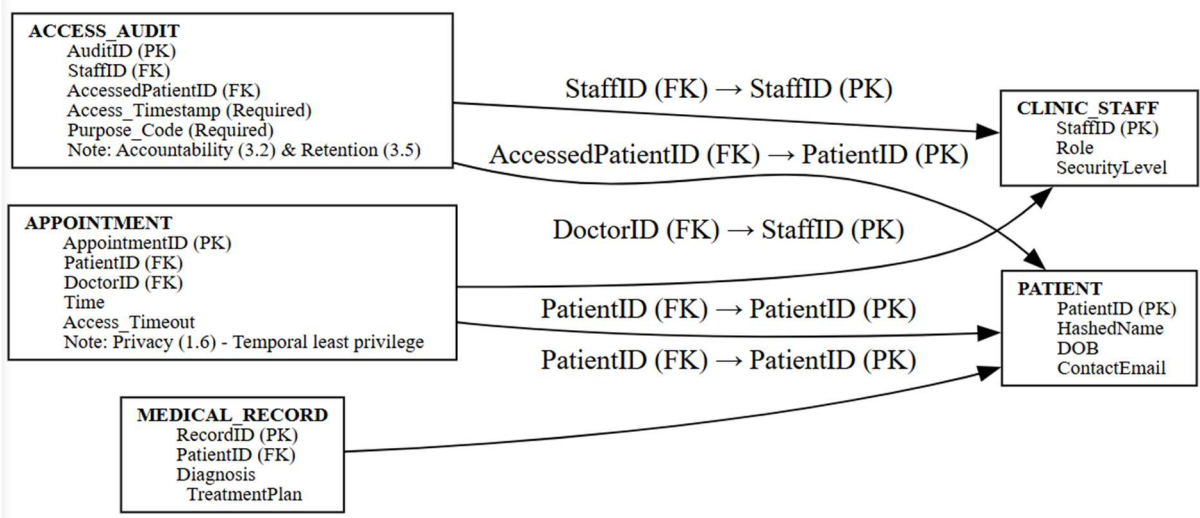
#### A. Gen-AI Prompt (Highly Analytical)

| Student's Prompt                                                                                                                                                                                                                                                                                                                                   | Analysis (Why this is Excellent)                                                                                                                                                                                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| "My ERD minimizes data for patient privacy (Code 1.6) but this makes it harder to audit staff who access the sensitive data (Code 3.2: Accountability). Suggest two specific, technical attributes or entities I could add to the ERD to maintain the patient's privacy while creating a robust, non-deletable record for ethical accountability." | This prompt is <b>highly analytical</b> because it explicitly defines the <b>conflict</b> (Privacy vs. Accountability). It is <b>technical</b> because it asks for a specific ERD modification ("attributes or entities") that resolves this trade-off without sacrificing either principle. |

#### B. Refined ERD (Nuanced Solution)

Based on the complex AI output (which likely suggested temporal auditing or differential access), the student implements a sophisticated **temporal security model**.

Artifact: Refined ERD (Changes in **bold**)



| Entity                      | Attributes                                                                                                                      | Ethical Link (Reinforcement)                                                                                                                                                                                                            |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PATIENT                     | ...                                                                                                                             | ...                                                                                                                                                                                                                                     |
| APPOINTMENT                 | ...                                                                                                                             | ...                                                                                                                                                                                                                                     |
| CLINIC_STAFF                | ...                                                                                                                             | ...                                                                                                                                                                                                                                     |
| NEW ENTITY:<br>ACCESS_AUDIT | AuditID (PK), StaffID (FK),<br>AccessedPatientID (FK),<br><b>Access_Timestamp (Required),</b><br><b>Purpose_Code (Required)</b> | <b>Accountability (3.2) &amp; Data Retention (3.5):</b> Requires staff to log the <i>reason</i> for access, making the log actionable for ethical auditing. The timestamp makes the record non-deletable for defined retention periods. |
| MODIFIED ATTRIBUTE          | APPOINTMENT.Access_Timeout                                                                                                      | <b>Privacy (1.6): Automatically sets a time limit</b> (e.g., 1 hour before appointment) after which the PatientID link becomes unavailable to non-doctor roles, enforcing least privilege only when data is actively needed.            |

**Student Justification for Refinement:** "The AI helped me confirm that accountability requires more than just logging *who* accessed data. My final ERD resolves the **Privacy vs. Accountability** trade-off by making two crucial changes:

1. **Temporal Security:** Adding Access\_Timeout to the APPOINTMENT table (a control structure/conditional logic concept) ensures the privacy link is only available right before it's needed for professional work (satisfying Code 1.6).

2. **Robust Auditing:** The new ACCESS\_AUDIT entity records not just *when* and *who* accessed the data, but *why* (Purpose\_Code). This makes the log itself an ethical tool, allowing auditors to verify if access was necessary, thereby providing a robust measure for **Accountability (Code 3.2)**."

### 3. Acknowledgments

I would like to extend my sincere gratitude to Prof. Rajan Ranjidha for her contribution to this OER.

### 4. References

Awad, E., Dsouza, S., Kim, R., et al. (2018). The Moral Machine experiment. *Nature*, 563(7729), 59–64. <https://doi.org/10.1038/s41586-018-0637-6>

Rajan, R., & Cortinovis, R. (2024). Ethical integration in computer science education: Leveraging open educational resources and generative artificial intelligence for enhanced learning. In *Proceedings of the 35th Annual Workshop of the Psychology of Programming Interest Group (PPIG), in conjunction with VL/HCC* (pp. 151–159). PPIG. <https://www.ppig.org/files/2024-PPIG-35th-rajan.pdf>